

(12) **UK Patent Application** (19) **GB** (11) **2 291 285** (13) **A**

(43) Date of A Publication 17.01.1996

(21) Application No 9518163.2

(22) Date of Filing 15.02.1993

Date Lodged 06.09.1995

(30) Priority Data

(31) 4206092 (32) 27.02.1992 (33) DE

(62) Derived from Application No. 9302963.5 under Section 15(4) of the Patents Act 1977

(51) INT CL<sup>6</sup>

H01R 17/12

(52) UK CL (Edition O )

H2E ECR EDMX

(56) Documents Cited

None

(58) Field of Search

UK CL (Edition N ) H2E

INT CL<sup>6</sup> H01R

(71) Applicant(s)

Spinner GmbH Elektrotechnische Fabrik

(Incorporated in the Federal Republic of Germany)

Erzgiesserei strasse 33, 8000 Munchen 2,  
Federal Republic of Germany

(74) Agent and/or Address for Service

D Young & Co  
21 New Fetter Lane, LONDON, EC4A 1DA,  
United Kingdom

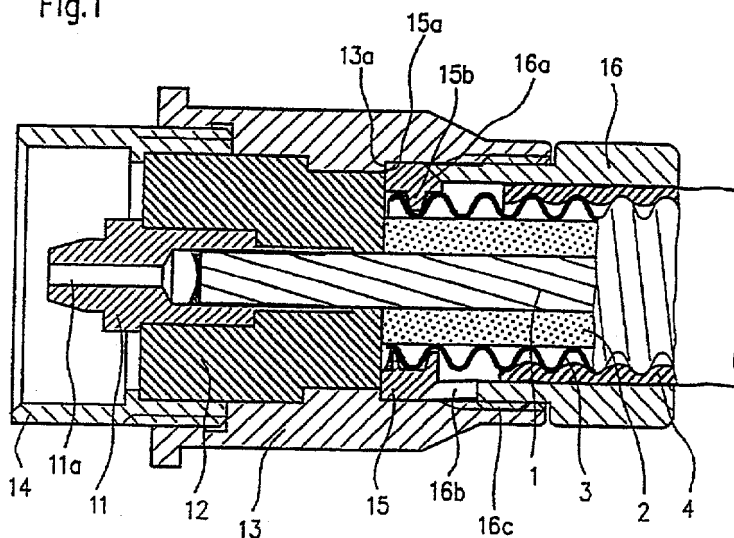
(72) Inventor(s)

Georg Spinner  
Franz Xaver Pitschi  
Peter Stiefel

(54) **Coaxial plug-in connection**

(57) A coaxial plug-in connection which is of particularly low intermodulation is obtained if the outer conductor (3) of the cable is soldered to a thrust ring (15) in the region of the front end thereof, and the thrust ring (15) is pressed using a hollow screw (16) against an annular collar (13a) on the inner wall of the housing (13). All parts of the plug-in connection disposed in the contacting region are silver-plated. The screw (16) is radially slit (16b) and a sealing ring can be interposed between the screw and thrust ring or thrust ring and housing.

Fig.1



GB 2 291 285 A

Fig.1

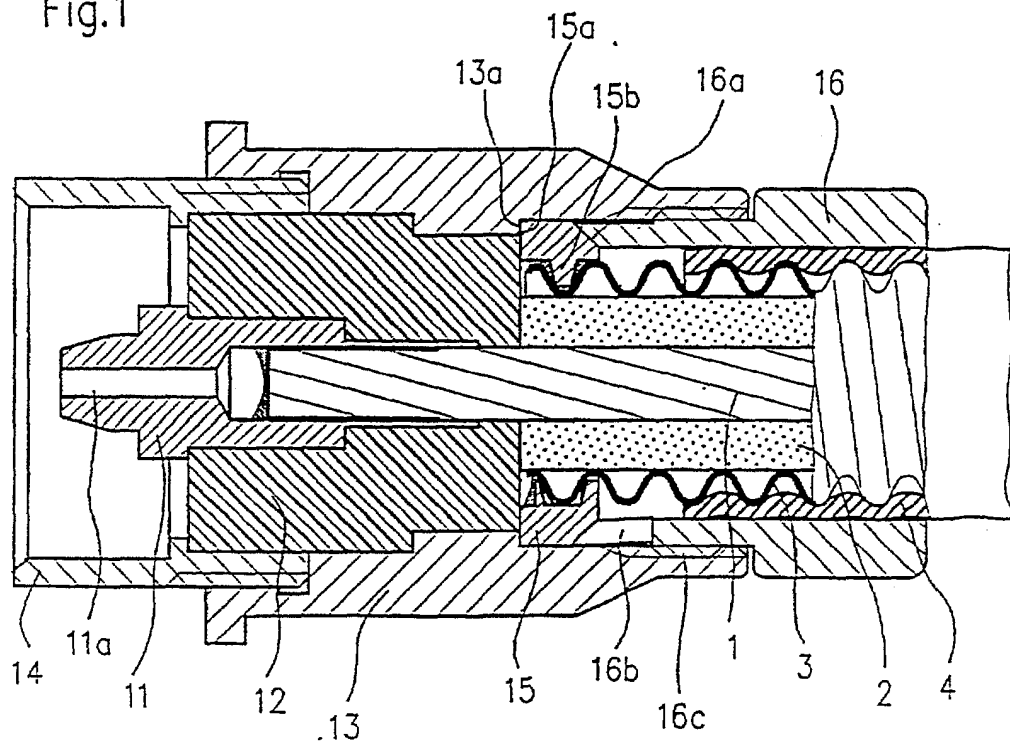


Fig.2

2/2

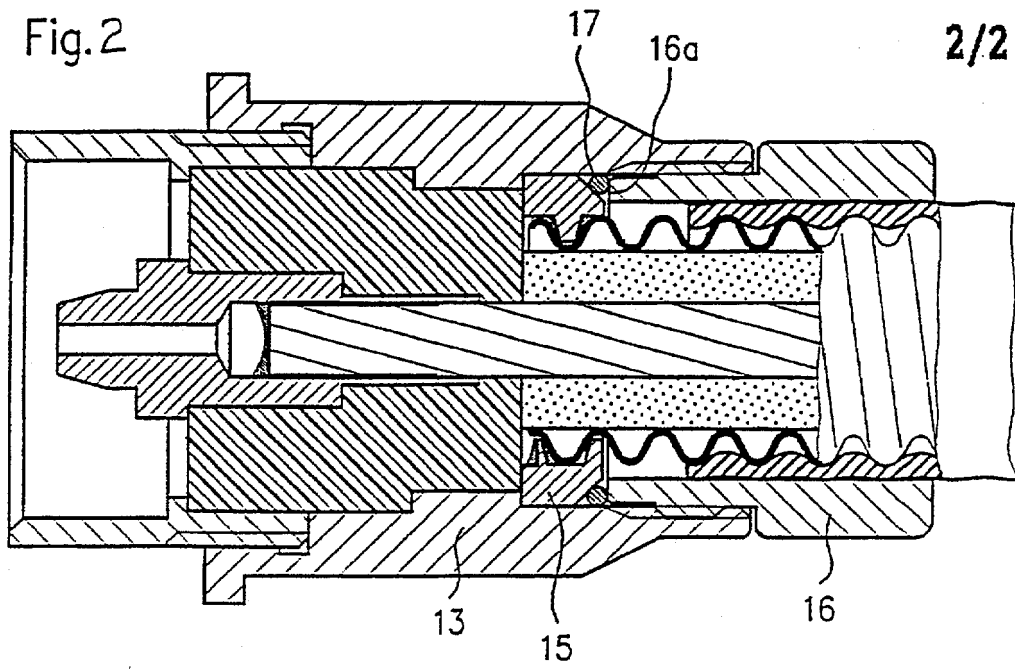


Fig.3

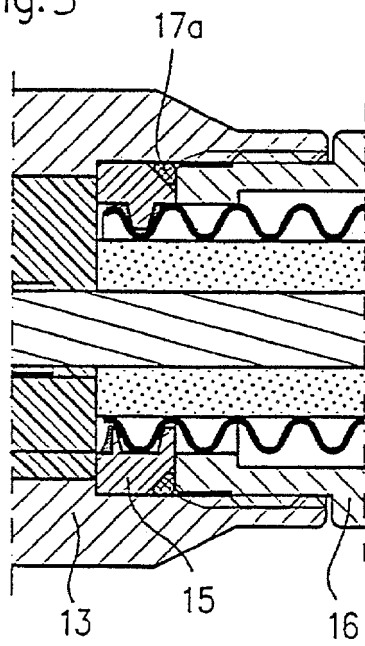
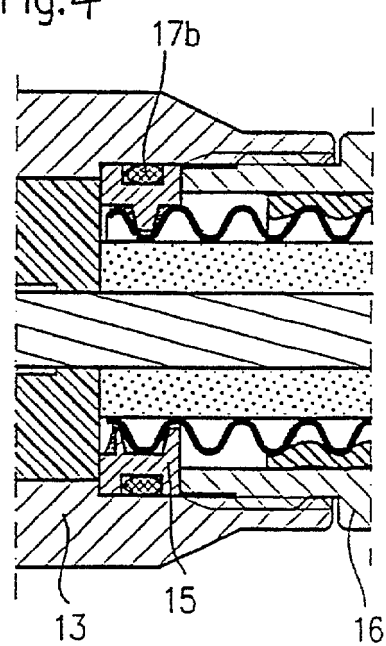


Fig.4



COAXIAL PLUG-IN CONNECTION

The invention relates to a coaxial plug-in connection. In particular, but not exclusively the invention relates to such a connection comprising a plug, including an  
5 inner conductor and a housing at one end of a cable, the cable including a tubular outer conductor and an inner conductor; the cable inner conductor being joined to the plug inner conductor; and the cable outer conductor terminating in a bore in the plug housing with the cable outer conductor mechanically engaged in the plug housing and in electrical contact therewith in the region of the front end of the outer conductor by  
10 means of a thrust ring and a hollow screw which is screwed into the bore in the housing.

Plug-in connections of these kinds are known in general for high-grade coaxial cables, in particular those with a solid outer conductor which can be smooth, corrugated in screw-like manner or annularly corrugated. For the purpose of  
15 mechanical clamping, but above all for the purpose of safe electrical contacting, the outer conductor is usually widened in the region of its front end, or is flanged outwardly at right angles to form a collar. The widened region or the collar is clamped between a corresponding annular face of the housing and the annular front face or even conical face of a thrust ring by being screwed in by a hollow screw  
20 member, the front face of which rests against the thrust ring, and simultaneously making an electrical contact with the plug housing. It has now been shown that this contact, which is of very low resistance and therefore of poor reflection, is insufficient in some cases, namely if a particularly high intermodulation distance is required, e.g. more than 120 dB for intermodulation products of third order. This is the case, for  
25 example, with coaxial connections by means of which signals are simultaneously transmitted at high output and received with very low output.

According to the invention, there is provided a coaxial plug-in connection comprising a plug, including an inner conductor and a housing at one end of a cable, the cable including a tubular outer conductor and an inner conductor; the cable inner  
30 conductor being joined to the plug inner conductor; and the cable outer conductor terminating in a bore in the plug housing with the cable outer conductor mechanically

engaged in the plug housing and in the region of the front end of the outer conductor being in electrical contact with the plug housing by means of a thrust ring and a hollow screw which is screwed into the bore in the housing, wherein the thrust ring is soldered to the outer conductor in the region of the front end of the outer conductor  
5 and has an annular shoulder which projects axially beyond the front end of the outer conductor and makes contact with an annular collar on the inner wall of the housing; and wherein all surfaces which effect said electrical contact between the outer conductor of the cable and the plug housing are silver plated.

This is advantageous in that the plug housing as a whole does not need to be  
10 soldered to the outer conductor. (This can be difficult depending on the design of the plug, particularly if the plug inner conductor and plug dielectric are not subsequently fitted from the plug side.) Thus use is made, as hitherto, of a thrust ring and a screw member. However, the outer conductor is not mechanically clamped, but is firstly soldered to the thrust ring. Mechanical clamping is effected, as hitherto, by means of  
15 a hollow screw which acts upon the thrust ring. It has been shown that in this case too, non-linear parts of the contact resistance are avoided to a great extent, and thus intermodulation effects can be pushed beneath the measurable limit, on the further condition that all contact providing parts are silver-plated.

Preferably, the connection is adapted to use with a coaxial cable having a  
20 corrugated outer conductor, wherein the inside of the thrust ring has a profile which is complementary to the corrugation of the outer conductor. Conveniently the thrust ring is axially divided.

A connection of the invention facilitates the relative positioning of the thrust ring and outer conductor before and during the soldering on process of the thrust ring.

25 It is preferable that the annular end face of the hollow screw and the corresponding face of the thrust ring are in the form of complementary conical faces.

Thus due consideration is taken of the fact that the contacting faces between the thrust ring and the housing, on the one hand, and between the hollow screw and the housing, on the other hand, are, from the electrical viewpoint, parallel switched  
30 transmission- and contacting resistances, so that it is recommended that to minimise the entire effective contact resistance, the contact face between the hollow screw and

thrust ring also be kept to a minimum in size and that simultaneously a high surface pressure in that region also be produced.

Preferably, the hollow screw has mutually spaced apart axial slits emanating from its conical front face, the slits imparting radial resilience to the hollow screw in the region of its front face.

Thus, the surface pressure between the hollow screw and housing is also increased, particularly in the current-conducting region.

Conveniently, in the region of the thrust ring, a sealing ring is arranged which seals at least the peripheral gap between the thrust ring and the housing against moisture entering at the cable side in the direction of the plug side.

The plug-in connection is thus made water-tight. Any water which may penetrate into the plug-in connection from the side of the cable can actually only penetrate so far as the end face, on the side of the cable, of the thrust ring, but not into the critical region between the inner conductor and the outer conductor of the cable or between the plug inner conductor and the housing of the plug-in connection.

The invention is diagrammatically illustrated by way of example in the accompanying drawings, in which:

Figure 1 shows a plug-in connection according to the invention;

Figure 2 shows a sealed variant;

Figure 3 shows a second possible way of effecting sealing; and

Figure 4 shows a third possible way of effecting sealing.

In the drawings, the following reference numerals have the following means:

	1	=	cable inner conductor
	2	=	cable dielectric
25	3	=	cable outer conductor
	4	=	cable casing
	11	=	plug inner conductor
	12	=	plug dielectric
	13	=	plug housing
30	14	=	flange on plug side.

In Figure 1, the cable outer conductor 3 is soldered in the contacting region 20

over the whole of its outer periphery to the inner wall of the plug housing 13 which is integrally designed and which has a profile which is complementary to the screw-like corrugation of the cable outer conductor 3, as indicated at 13a. With this embodiment, the plug dielectric 12 and the plug inner conductor 11 must be fitted  
5 from the plug side, thus from the left in the drawing. The flange 14 on the plug side is in the form of a screw flange, and has an inwardly projecting annular shoulder 14a to secure the position of the plug dielectric 12. The cable inner conductor 1 is received in a corresponding bore in the plug inner conductor 11 and is soldered therein.

10 With the plug-in connection shown in Figure 1, contact between the cable outer conductor 3 and the plug housing 13 is provided by a thrust ring 15 and a hollow screw 16 which is screwed into the housing 13. The thrust ring 15 has a profile which is complementary to the corrugation of the outer conductor 3, as shown at 15b. The thrust ring 15 is soldered to the end of the outer conductor 3, and has an  
15 annular shoulder 15a which projects in the axial extent over the front end of the outer conductor 3 and whereby it makes contact with the annular collar 13a of the plug housing 13. The plug housing 13 and also the thrust ring 15 are silver-plated in this contacting region at least. However, it is recommended that the housing 13 be silver-plated at least in the entire region of contact with the thrust ring 15. The entire  
20 thrust ring 15 should be silver-plated. The same is true of the front region, on the plug side, of the hollow screw 16. To increase the contact surface between the thrust ring 15 and the front end of the hollow screw 16, the front face 16a thereof and the companion face of the thrust ring 15 are in the form of complementary conical faces. From its front face 16a, the hollow screw 16 is also provided with axial slits 16b  
25 which are distributed symmetrically around the periphery and which extend as far as the screwthreaded section 16c of the hollow screw 16. The resilient behaviour in the radial extent which is provided thereby in the region of the annular end face 16a of the hollow screw 16, together with the conical faces, means that as the hollow screw 16 continues to be tightened, its front region is increasingly pressed against the inner  
30 wall of the plug housing 13. It can be mathematically shown that both the conical casing face between the thrust ring 15 and the hollow screw 16 and also the

cylindrical face between this latter and the plug housing 13 form contacting faces by means of which a fraction – even though only a very small fraction – of the current flows between the cable outer conductor 3 and the plug housing 13. It is therefore recommended that when very high attenuation requirements are imposed upon  
5 intermodulation products, these contacting regions too should be silver-plated because otherwise specific transfer- or contacting resistance which fluctuate in the peripheral extend can be produced, and above all oxide layers can form, which, owing to their non-linear electric properties are considered to be the primary cause of the formation of intermodulation products.

10        Figure 2 shows a sealed embodiment of the plug-in connection according to Figure 1. The sealing is provided by an o-ring 17 which is inserted into a peripheral groove which is delimited by the end face 16a, in this case a circular end face, of the hollow screw 16, the conically tapering companion face, as in Figure 1, of the thrust ring 15, and the inner wall of the bore of the plug housing 13. The slits in the front  
15 region of the hollow screw 16 are dispensed with in this embodiment.

According to Figure 3, a profile ring 17a can be used instead of a simple o-ring to provide the sealing function.

According to Figure 4, sealing can also be provided in a similar way by means of a sealing ring 17b which is inserted into a peripheral groove in the thrust ring 15.



**CLAIMS**

1. A coaxial plug-in connection comprising a plug, including an inner conductor and a housing at one end of a cable, the cable including a tubular outer conductor and an inner conductor; the cable inner conductor being joined to the plug inner conductor; and the cable outer conductor terminating in a bore in the plug housing with the cable outer conductor mechanically engaged in the plug housing and in the region of the front end of the outer conductor being in electrical contact with the plug housing by means of a thrust ring and a hollow screw which is screwed into the bore in the housing, wherein the thrust ring is soldered to the outer conductor in the region of the front end of the outer conductor and has an annular shoulder which projects axially beyond the front end of the outer conductor and makes contact with an annular collar on the inner wall of the housing; and wherein all surfaces which effect said electrical contact between the outer conductor of the cable and the plug housing are silver plated.
2. A plug-in connection according to claim 1 adapted for use with a coaxial cable having a corrugated outer conductor, wherein the inside of the thrust ring has a profile which is complementary to the corrugation of the outer conductor.
3. A plug-in connection according to claim 2 adapted for use with a coaxial cable having an annularly corrugated outer conductor, wherein the thrust ring is axially divided.
4. A plug-in connection according to any one of claims 1 to 3, wherein the annular end face of the hollow screw and the corresponding face of the thrust ring are in the form of complementary conical faces.
5. A plug-in connection according to claim 4, wherein the hollow screw has mutually spaced apart axial slits emanating from its conical front face, the slits imparting radial resilience to the hollow screw in the region of its front face.

6. A plug-in connection according to any one of claims 1 to 5, wherein in the region of the thrust ring, a sealing ring is arranged which seals at least the peripheral gap between the thrust ring and the housing against moisture entering at the cable side in the direction of the plug side.

5

7. A plug-in connection substantially as hereinbefore described and illustrated with reference to the accompanying drawings.

<b>Patents Act 1977</b> <b>aminer's report to the Comptroller under Section 17</b> <b>The Search report)</b>	<b>Application number</b> <b>GB 9518163.2</b>
<b>Relevant Technical Fields</b>  (i) UK CI (Ed.N)      H2E (ii) Int CI (Ed.6)      H01R  <b>Databases (see below)</b> (i) UK Patent Office collections of GB, EP, WO and US patent specifications.  (ii)	<b>Search Examiner</b> <b>MRS J BANNISTER</b>  <b>Date of completion of Search</b> <b>5 OCTOBER 1995</b>  <b>Documents considered relevant following a search in respect of Claims :-</b> <b>ALL</b>

**Categories of documents**

<b>X:</b> Document indicating lack of novelty or of inventive step.	<b>P:</b> Document published on or after the declared priority date but before the filing date of the present application.
<b>Y:</b> Document indicating lack of inventive step if combined with one or more other documents of the same category.	<b>E:</b> Patent document published on or after, but with priority date earlier than, the filing date of the present application.
<b>A:</b> Document indicating technological background and/or state of the art.	<b>&amp;:</b> Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

**Databases:** The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).